Tensile Properties of 3D Printed Materials

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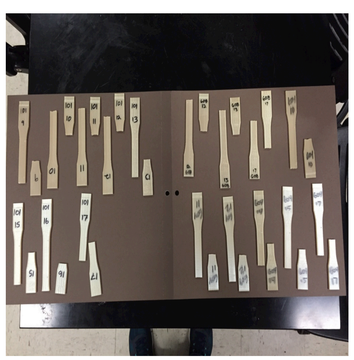
Research Objective: Perform tensile testing of Fused Deposition Modeling materials to determine variability due to orientation and print machine.

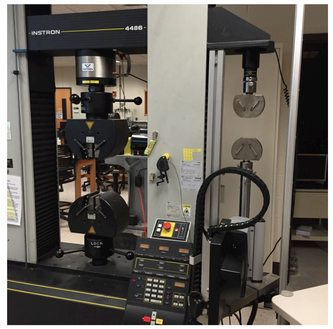
Introduction:

- 3D printers can create the same product, but the orientation and printer may influence the variability of strength between identical products.
- The products tested were printed using the **Fused Depostion Modeling** process. (Stratasys FORTUS 900mc)

- The Ultem samples tested were produced on 6 different printers.
- There were three orientations tested; ZXY, YZX, and YXZ.



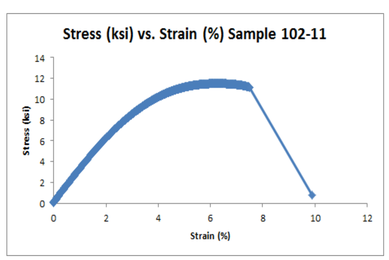
Methodology:

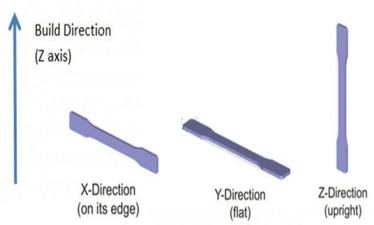


- Specimens were tested using ASTM 638 standards on an Instron 4486 using Bluehill software.
- All group members were involved in testing process which included sample testing, recording data, placing extensometer, analyzing data, and running Bluehill program.
- Testing procedures were completed on multiple days to include humidity, temperature, and human variability.

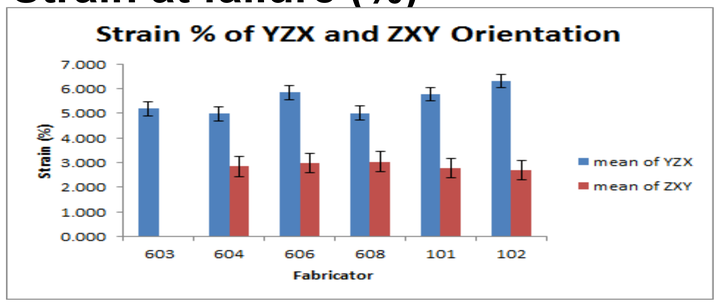
Analysis:

- Calculated the Ultimate Tensile Strength (UTS), Stress at Failure, Strain at Failure, and Elastic Modulus.

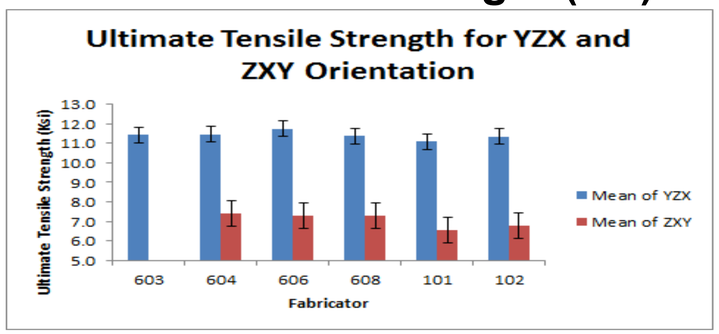




Strain at failure (%)



Ultimate Tensile Strength (ksi)



Conclusions:

- ZXY has the weakest UTS and smallest strain compared to YZX and YXZ orientation. YZX has the highest UTS and strain of all orientations tested.
- Statistically, each orientation from the various printers has similar tensile properties.

This material is based upon work supported by the National Science Foundation under Grant No. Any 1405923 opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.